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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/980,754	02/15/2002	Wilfred Lerch	Az. 2964	7497

30996 7590 12/03/2002

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EXAMINER

MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 12/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/980,754

Applicant(s)

LERCH ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 September 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 28-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 28-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>8</u> | 6) <input type="checkbox"/> Other: _____ |

GROUND OF THE REJECTION

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 28-35, 37, 38 and 44-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kodama (U.S. 5,967,794).

In reference to claim 28, Kodama in a related method to control the formation of doped regions teach controlling at least one of a concentration and a distribution of defects or vacancies as a function of a process gas atmosphere; and prior to a thermal treatment, removing a natural SiO₂ layer from a surface of a semiconductor and producing a silicon nitride layer (6B) on said semiconductor (column 6, lines 25-55). Kodama fails to teach producing the silicon nitride layer having a thickness of up to 4nm on said semiconductor. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

In reference to claims 29-35, Kodama teaches said defects are vacancies; said defects are semiconductor substrate atoms on interstitial lattice positions; the composition of the process gas is controlled, said composition comprising the concentration of the gas; the process gas including a nitrogen-containing gas, said gas comprising nitrogen. Kodama fails to teach controlling a partial pressure of the gas. However, Kodama teaches controlling the concentration of the gas by controlling the gas flow rate on a reaction chamber, which inherently teaches controlling the partial pressure of a process gas because controlling the concentration of the mixing gas can control the partial pressure.

In reference to claims 37 and 38, Kodama teaches including an oxygen-containing component, including at least one of N_2O , NO and H_2O (column 6, lines 25-32).

In reference to claims 44-49, Kodama teaches controlling a distribution of foreign atoms within a semiconductor material by means of distribution of said defects; said foreign atoms include at least boron; carrying out the process on a doped semiconductor; doping into said semiconductor by at least one of gas phase doping, implantation; and out-diffusing from a layer that is in contact with said semiconductor (column 6, lines 25-55).

3. Claims 36, 39, 41 and 42 rejected under 35 U.S.C. 103(a) as being unpatentable over Kodama ('794) as applied to claims 28-35, 37, 38 and 44-49 above, and further in view of Wolf et al.

In reference to claims 36, 39, 41 and 42, Kodama substantially teaches all aspects of the specification but fails to show that the process gas contains no oxygen; that a temperature behavior of a thermal treatment is controlled in terms of time; and that the process includes NH_3 having a concentration of 0 to 10,000ppm. However, Wolf et al. in a related art to the deposition of silicon nitride film teach that silicon nitride depositions by LPCVD are controlled by many deposition parameters including total pressure partial pressure, thermal gradients, among others, using gases containing no oxygen including NH_3 (pages 192-193). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to control the deposition parameters of silicon nitride and using NH_3 as taught by Wolf in the doped-formation method of Kodama, since by controlling deposition parameters it would produce an uniform film with a low processing cost (page 192).

Kodama in combination with Wolf et al. fail to teach depositing silicon nitride using NH_3 gas at a concentration between 0 and 10,000ppm. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Response to Arguments

4. Applicant's arguments filed 9/28/2002 have been fully considered but they are not persuasive.

Applicants' argue that the claimed inventions seek to achieve a defect-enhanced diffusion, and Kodama seeks to prevent it. In response to this argument, defect-enhanced diffusion is a process caused by a thermal process causing accelerated diffusion of the dopants. If this process is not controlled, the doping profile of a doped area may be affected. According to the process as taught by Kodama, one of the results of the taught process is to restrain this defect-enhanced diffusion, not eliminating it (column 6, line 66 – column 7, line 5). This is done by controlling the flow of nitrous oxide deposited on the defects of a silicon layer (column 6, lines 42-55). Accordingly Kodama teaches "controlling at least one of a concentration and a distribution of defects or vacancies as a function of a process gas atmosphere" as claimed.

Also, applicants' argue that the growth of silicon nitride to a thickness of 4 nm is for the purpose of preventing out-diffusion and accordingly the examiner's assertion that the slight thickness of 4nm is merely an optimization of the layer thickness of Kodama, is incorrect. In response to this argument, the examiner respectfully submits that silicon nitride is a well-known material used to prevent out diffusion of dopants (e.g. Ahmad et al. to U.S. 6,319,779 B1, column 5, lines 35-49 and Cho to U.S. 5,387,548, column 2, lines 14-55). Furthermore, the nitride of Kodama is formed to a thickness of 10 – 20 nm (column 6, lines 42 – 45). Therefore, the examiner respectfully submits that the silicon nitride of Kodama can prevent out diffusion of dopants and accordingly the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone

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are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at (703) 308-0956.

Julio J. Maldonado

Patent Examiner

Art Unit 2823

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Olik Chaudhuri
SPE
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